

IAEA Training Sessions – Summary

Session 1: **Nuclear Waste Disposal Concepts**

Content: Somewhat of a historical perspective; the evolution of the Geological Disposal Concept from a world wide perspective. Could address early concepts such as seabed, subduction zone, volcano or outer space disposition as well as reprocessing and transmutation. Disposition concepts such as disposal, long term storage, retrievability and reversibility should be addressed. Closing remarks could include comments on public perception and acceptance of the concept of geologic disposal.

The entire course as presently envisioned will be oriented to the YM – ESF and the AECL – URL so a context that represents both the U.S. and Canadian programs will be appropriate.

Session 2: **Nuclear Fuel Cycle**

Content: We have envisioned this session to review the evolution of the nuclear fuel cycle and how disposal concepts are addressed in current practice. Future developments including transmutation, advanced reactors, reduction of waste materials and other long term initiative that will bear on disposal issues can be discussed. Some commentary on International initiatives would be valuable information. This is intended to be a joint U.S. – Canadian training session so examples from the experiences of and future initiatives of those two countries would be appropriate.

Session 3: **Project Management in a Regulatory Environment**

Content: This session should present a synopsis of how an organization manages a project in a rigorous regulatory environment to include aspects of short and long term planning, QA programs, organizational structure, regulatory interactions, oversight by government and technical bodies etc. Issues of how a project addresses long term continuity of effort and institutional memory as well as budgetary considerations for very expensive, potentially controversial and very long duration projects.

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Session 4: **Technical Review and Oversight for Nuclear Waste Disposal Facilities**

Content: This session would provide perspectives from a technical review and oversight organization, in this case the Nuclear Waste Technical Review Board. The presentation should include discussion of the origins of the Board through congressional mandate, key objectives, independence, outreach to the public and some of the major points made by the Board over the last decade. The Board has had the opportunity to look at some

International disposal programs so some comparison and contrasts with those programs from the technical review and oversight perspective would be appropriate. It is intended to have a member of the U.S. Nuclear Waste Technical Review Board make the presentation.

Session 5: Perspectives of the Regulator for Nuclear Waste Disposal Facilities

Content: This session would offer the perspective of the regulator for the disposal system intended to be licensed and implemented by the United States. Historical context, comparison to the nuclear power plant licensing program, and similarities to International regulatory programs could be explored. It is intended that a senior official from the U.S. Nuclear Regulatory Program and actively involved in the Yucca Mountain Project will give this presentation.

Session 6: Organizational, Institutional and Social Considerations

Content: We have envisioned this session to address some of the organizational, institutional and social considerations that help frame nuclear waste disposition strategies including the influence of the nuclear power industry. The presentation should address organization of technical operations (highly reliable organizations) local community volunteerism and acceptance, “not in my backyard” issues, nuclear power proliferation if waste stream issues are resolved and the ethics of generational considerations. Some commentary on those (in International community) who have done well and not so well may be valuable. We currently envision a one to two hour presentation that could include opening remarks by three or four panel members and then discussion between the panelists and the audience.

Session 7: Site Screening and Selection

Content: This session will cover siting criteria from a regulatory perspective. It will include criteria based on technical considerations such as tectonic stability, geologic simplicity and hydrologic isolation. The session will also address non-technical considerations such as population proximity, future resource exploration and public acceptance. The evolution of the regulatory framework over time frames of several decades will be addressed.

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Session 8: **Preliminary Site Characterization**

Content: This session will be oriented toward what it takes to do preliminary site characterization for nuclear waste storage and/or disposal sites. It will discuss relevant requirements, site characterization plans, and a host of investigative considerations. Commentary will be offered on topics including geologic mapping, geophysical imaging, climate and infiltration (shallow drilling), geologic framework (deep drilling), rock and hydrologic properties. This will lead to the coverage of the development of preliminary conceptual models for major physical processes and how TSPA can be used as a characterization focusing mechanism/tool. TSPA will be covered in a subsequent session so treatment here will be rather cursory and cover application more than content of TSPA.

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Session 9: **Geoscience Knowledge Integration**

Content: This is intended to be a short session that discusses how data and information can be integrated into a comprehensive management system that emphasizes the output of knowledge and wisdom that can be used effectively for decision making at all levels of an organization. This is based on an U.S. Geological Survey methodology developed as part of an integrated regional ground water study for the Yucca Mountain Project. This study involved several earth science disciplines and numerous Federal, State and Local agencies. The principles of the methodology can be applied universally to studies in any geologic setting, any organization or any country for a variety of purposes including nuclear waste disposal.

Session 10: **Natural and Man-Made Natural Barriers**

Content: This session is intended to explore the attributes of natural barriers and how to go about describing and quantifying those attributes both from the scientific and regulatory perspective. The dominant physical processes associated with understanding the behavior of natural barriers in a nuclear waste disposal concept should be explored in the context of earlier remarks on site characterization and to prepare the ground for later presentations on the underground, modeling and TSPA. The man-made aspect of natural barriers may be discussed in the context of capillary barriers in underground openings.

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Session 11: **Engineered Barriers**

Content: This session should include a presentation of the AECL engineered barrier concept by addressing container design and testing, waste form testing, laboratory and underground studies in clay buffer materials, concrete sealing materials, and the concept of repository seals. A context should be established for what types of studies are important, the current state of technology, and how programs benefit from in-situ engineered barrier studies. Testing and analysis for engineered barriers will be an important aspect for the underground training the following week. Consequently, a context for those visits should be presented.

This will be primarily an AECL presentation since the AECL concept is more applicable to most international waste programs. A short 10 -15 minute commentary on the U.S. program with regard to the regulatory aspects of Engineered Barriers may be presented.

Session 12: **Underground Exploratory Studies**

Content: This session should focus on characterization studies in the underground and make reference to companion laboratory studies where applicable. Specific topics could include excavation methodology and excavation response; enhancement of process models with the collection of data from the geologic, hydrologic, and hydrogeochemical setting; in-situ stress, solute transport, and provisions for long term monitoring. This session should tie to aspects of many other sessions to include, Project Management in a Regulatory Environment, Preliminary Site Characterization, “Barriers”, Modeling and TSPA. The emphasis on coupled processes and how they are addressed with the various scale heater tests could be used as an approach to integrating the underground program.

This session should be the center piece for tying together some of the concepts of previous presentations and preparing the audience for modeling and TSPA presentations that will follow. It will provide a context for the underground visits the following week and make reference to examples that will be observed directly in the underground.

Session 13: **Modeling**

Content: The session will emphasize physical process modeling as applicable to nuclear waste disposal systems. The presentation could start with an overview of the development of conceptual models, predictive calculations for key processes, test design and execution, and refinement of models. Development of alternative conceptual models should be addressed as well as the concepts of calibration and validation from both the

scientific and regulatory perspective. Uncertainty quantification and reduction should be addressed. The role of modeling for site characterization, barrier analysis and total system performance assessments should be covered. Modeling with attendant analysis will be an important aspect for the underground training the following week. Consequently, a context for those visits should be presented.

Session 14: Total System Performance Assessment (TSPA)

Content: This session will start off with a discussion of the general concept of TSPA and how it is used to assess performance and also to inform the site characterization process. Some connection back to the session on Preliminary Site Characterization should be established as well as a connection forward to the “Barrier” and Modeling sessions. Individual sub-sections on U.S. and Canadian specific approaches and applications as examples can be presented followed by a summary or wrap-up session that comments on commonality and differences in approach as applicable. Commentary on the level of complexity achievable as well as simplified forms of TSPA analyses possible, keeping in mind the capabilities of developing countries, may be appropriate. In addition, we have added a sub-section on the Japanese performance assessment (H-12 report) and the possibility of an EPRI sub-section.

Session 15: Repository Design and Performance Confirmation

Content: This session will focus on the engineering design of a repository and the development of functional and performance requirements. By using the requirements as a guide the discussion will flow to the development of a laboratory program, as well as the development of engineering tools that would be required in the design of a deep geologic repository.

This will be primarily an AECL presentation since the AECL concept is more applicable to most international waste programs. A short 20-30 minute commentary on the U.S. program with regard to the regulatory aspects of Performance Confirmation will be presented at the close of the session.

Session 16: Worldwide Review of URLs and Nuclear Waste Disposal Developments

Content: This will be a presentation based on the three worldwide reviews of P.A. Witherspoon, editor, over the last fifteen years. Presentation could address; evolution of URLs for nuclear waste evaluation, URL international collaboration and information exchange, international and regional repository concepts and challenges for further development as waste disposal moves from concepts in URLs to implementation in geologic repositories.